# Transparency: Tracking Uranium under the U.S./Russian HEU Purchase Agreement

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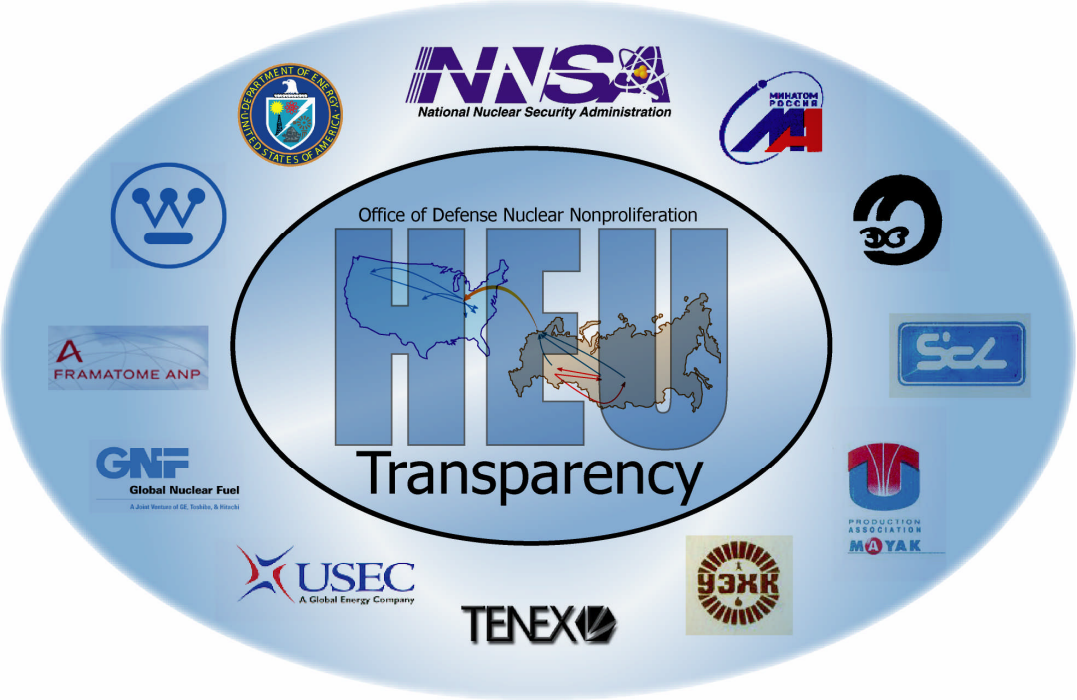


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# HEU Purchase Agreement

- An Agreement between the United States and the Russia Federation to convert 500 metric (MT) of highly enriched uranium (HEU) extracted from nuclear weapons into low enriched uranium (LEU) for use as fuel in commercial nuclear reactors.
- The Agreement, signed in February 1993, establishes a government-to-government relationship between the two countries. Each country benefits:
  - Transparency measures allow each government to assure that the objectives of the Agreement are met, including provisions for nuclear material accounting, control, and access.
  - The sale of the LEU provides Russia with much needed funds.
- The transparency measures are performed at the government level.
- The sale of the LEU is a separate commercial arrangement/contract.

Provides 10% of U.S. electrical power.

# HEU Transparency Program

- The Highly Enriched Uranium Transparency Program is responsible for monitoring the the processing of uranium for the 1993 HEU Purchase Agreement to help provide overall confidence that the Agreement's objectives are being met.
- United States nonproliferation goals are met by assuring the permanent removal of 500 MT of weapons-grade HEU from Russia, equivalent to about 20,000 nuclear devices.
- Joint U.S./R.F. statement of September 15, 2005 described the HEU Agreement "as one of the most significant bilateral political initiatives between our countries."
- Transparency measures are not a verification process. They are negotiated and agreed upon by both countries, and are subject to the rules and regulations of the host country.

# HEU Transparency Program Goals

- Transparency measures are to assure that:

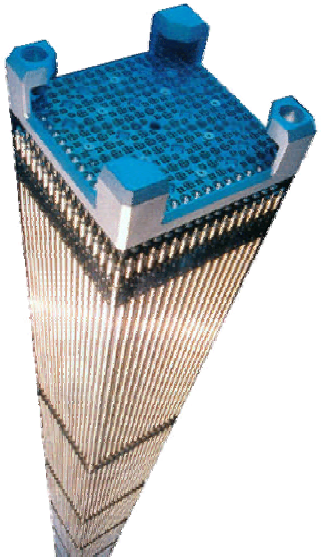
*HEU Transparency Program monitor at Russian facility glove box with HEU metal being oxidized (burned)*

***HEU is extracted from dismantled Russian nuclear weapons.***

***This same HEU is converted and downblended to LEU.***

*Nuclear weapons display in Russia*

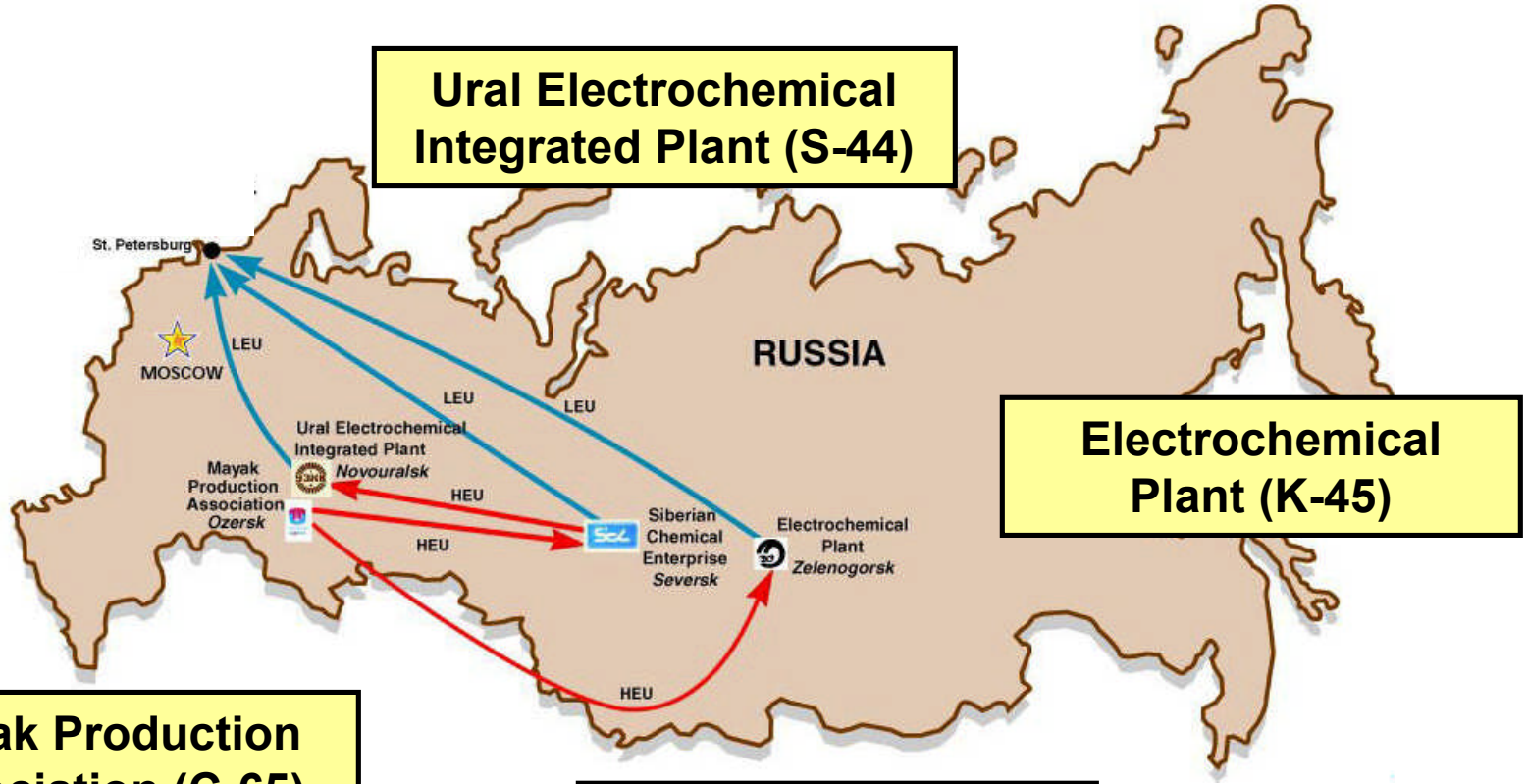
***The LEU shipped to the United States is fabricated into fuel for commercial nuclear reactors.***



*Fuel assembly ready for insertion into a nuclear reactor*

- These measures support U.S. nonproliferation policy initiatives to permanently dispose of HEU weapons material.

# Russian Facilities Subject to the Agreement




*Arrows Indicate the Flow of Material*
*Red is HEU* *Blue is LEU*

# Russian Facilities and Processes

Two Russian facilities receive HEU weapons components from dismantled Russian nuclear weapons

## *Siberian Chemical Enterprise (SChE)* in Seversk

*HEU Transparency Program monitors inspect weapon component transport containers at MPA*

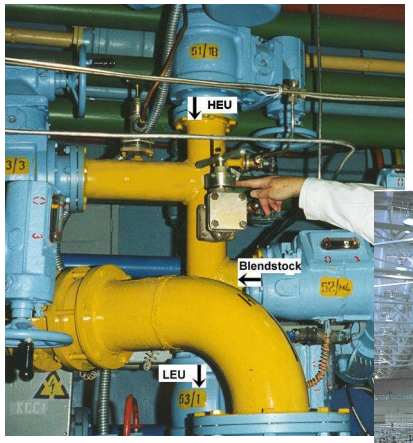
- Receive weapons components
- Convert metal components to chips
- Convert metal chips to oxide
- Purify the oxide
- Ship purified oxide to SChE & ECP

*HEU Transparency Program monitors inspect HEU oxide containers at MPA*

## *Mayak Production Association (MPA) in Ozersk*

# Russian Facilities and Processes

Three Russian facilities convert and blend down HEU to LEU for shipment to the United States




*Blend point at SChE*

**Siberian Chemical Enterprise**

*LEU cylinder filling station at ECP*

**Electrochemical Plant (ECP) in Zelenogorsk**

- Receive HEU oxide
- Convert oxide to $UF_6$
- Down blend HEU into LEU
- Ship LEU to USEC

**Ural Electrochemical Integrated Plant (UEIP) in Novouralsk**

# Process Facilities in the United States

**Paducah Gaseous Diffusion Plant receives the LEU shipped from Russia (*since May 2002*).**

**A Russian Monitoring visit to the United States was just completed in October 2005.**

**Four fuel fabricators convert Russian origin LEU into commercial power reactor fuel:**

*Three Russian monitors (left) at Global Nuclear Fuel inspecting cylinders that contain LEU purchased from Russia*

- ***Global Nuclear Fuel - Americas, Wilmington, NC***
- ***Framatome-Lynchburg, Lynchburg, VA***
- ***Framatome-Richland, Richland, WA***
- ***Westinghouse Fuel Fabrication Facility, Columbia, SC***

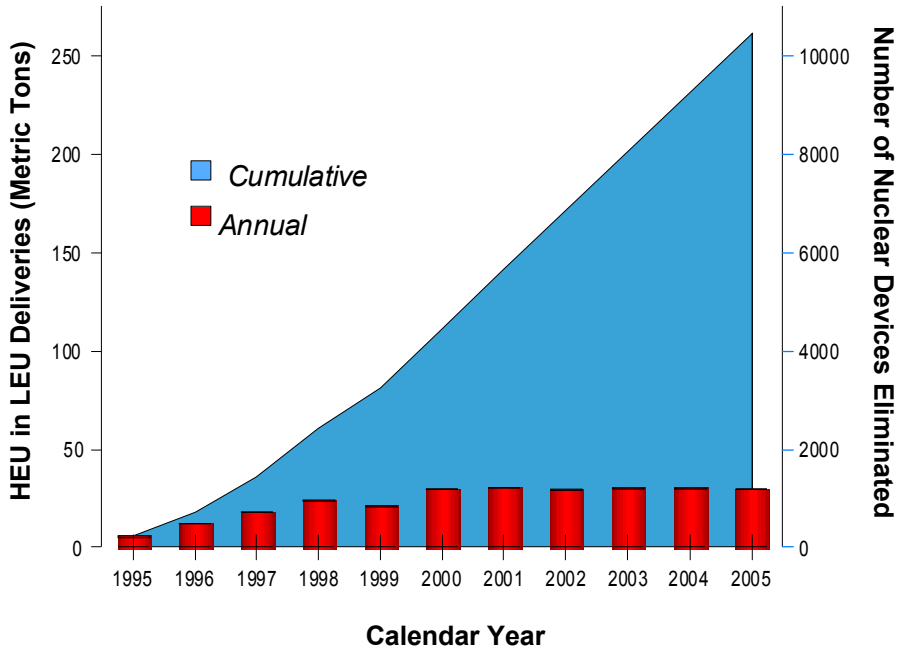
**Russian Transparency Rights End at the Fabrication Facility**

# Russian Monitoring Visit
# October 3-12, 2005


*Russian Monitoring Team at Framatome-Richland, Richland, WA*


*Russian Monitoring Team and U.S. Hosts At Paducah Gaseous Diffusion Plant, Paducah, KY And At Global Nuclear Fuel - Americas, Wilmington, NC*

# Russian HEU Conversion Rates




- In August 2005 the program reached the half-way point, when the 250th MT of HEU used to produce the LEU was delivered.
- 250 MT of HEU is equivalent to 10,000 nuclear devices*.
- By the end of 2005, Russia will have delivered 7,670 MT of LEU containing 48 million SWU and 79 thousand MT of natural uranium.
- Conversion of 500 MT of HEU into 15,000 MT of LEU should be completed in 2013 and delivered under the 20-year agreement.

*** Per IAEA standard for significant quantity of nuclear material**

# HEU Transparency Information Process

Monitors gather data on material processing rates and material containers in Russian plant storage and process areas.

Weapons Component

Chips

Oxidation

Purification

Fluorination

Blending

HEU Feed (LEU)

LEU - Product

Monitoring Tools

- Technical Experts
- Physical Observations
- Measurements
- Accountability Documents
- Monitoring Information

Transparency monitoring data and analysis are compared with Russian declared processing rates, inventories, and HEU accountability records.

Russia

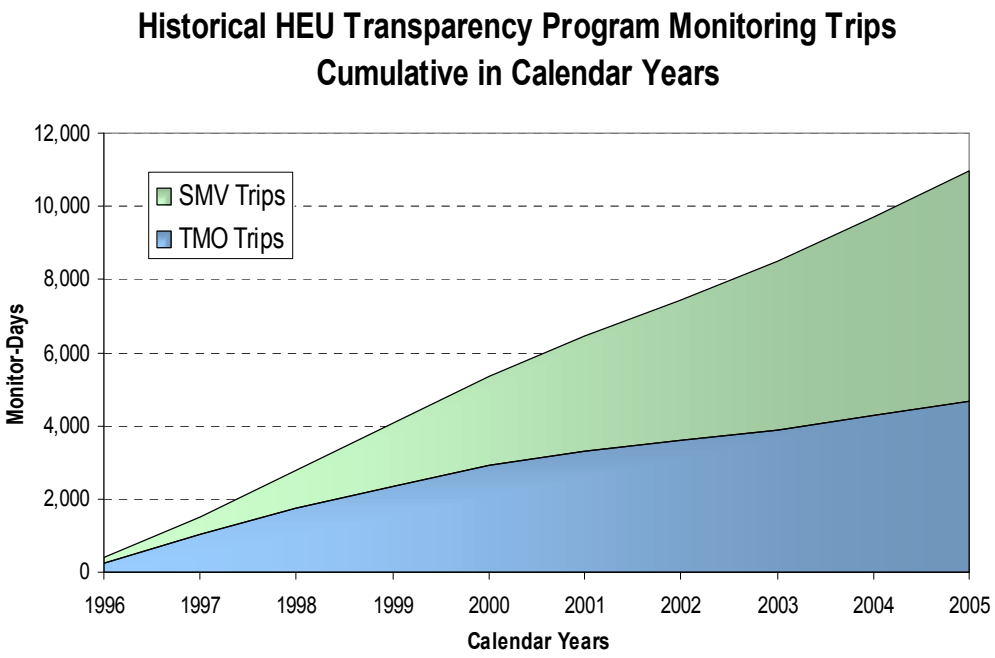
U.S.

USEC
A Global Energy Company

Info. Mgmt.

Evaluations

# HEU Transparency Monitoring Trips

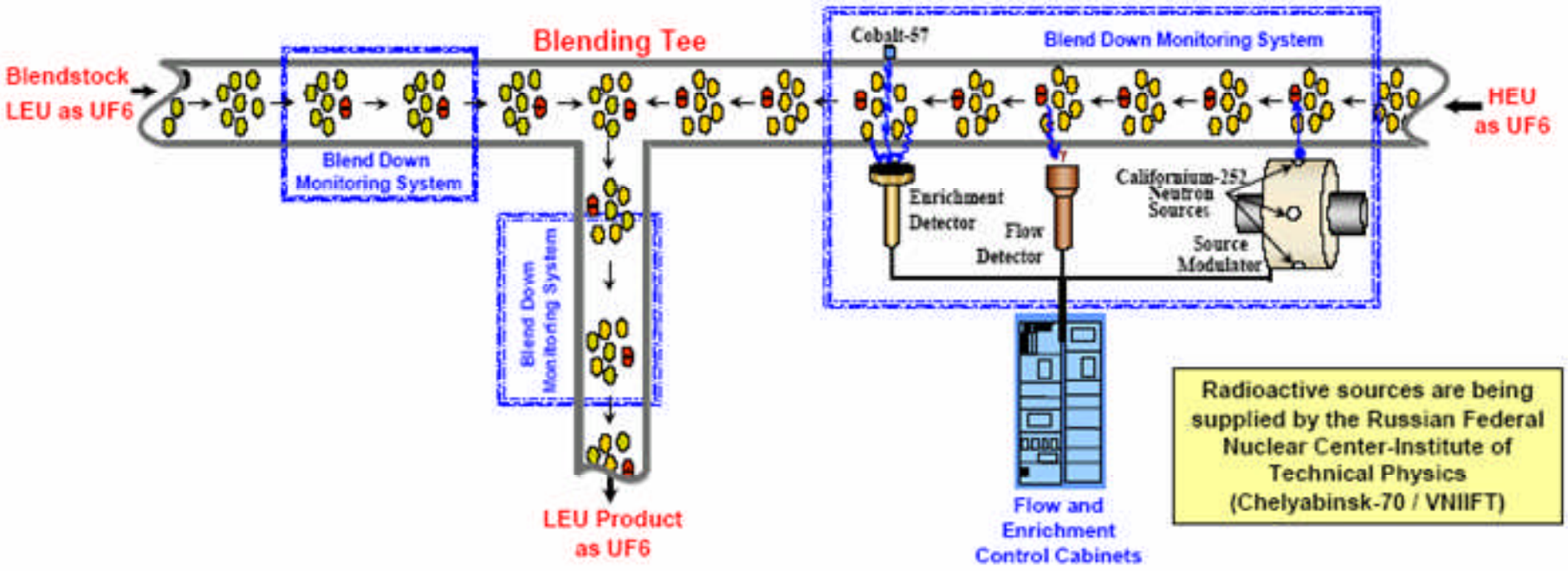



- During 2005 there will be 24 Special Monitoring Visits (SMV) to four Russian processing plants and 14 monitors assigned to the Transparency Monitoring Office (TMO) at UEIP.
- From 1993 through 2004:
  - 139 TMO monitors (4,287 monitor-days)
  - 160 SMV trips (5,447 monitor-days)
  - 12 Familiarization trips
- Maximum coverage allows 24 SMV trips per year and a TMO staffed up to 12 months per year.

# We use portable NDA equipment in Russia to measure HEU enrichment

- The equipment has been used in the Russian facilities since 1997
- This equipment uses a sodium iodide detector and a portable multi-channel analyzer
- The precision of this low-resolution device is sufficient for the requirements of HEU Transparency

# The Blend Down Monitoring System (BDMS) is an important U.S. independent measurement




## BDMS

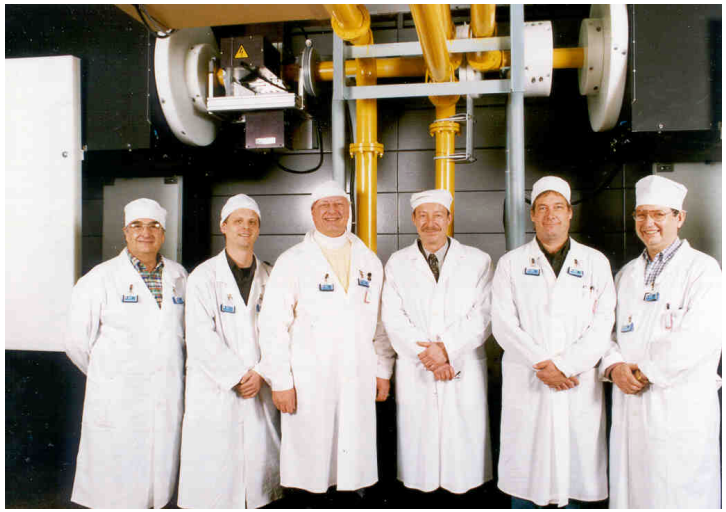
- Measures HEU and product flows and enrichments with U.S. instruments
- Measurements are then compared with Russian enrichment and process data
- Excellent agreement to date has provided strong assurance to the U.S.

# The BDMS equipment was installed at UEIP in 1999 and ECP in 2003

National Nuclear Security Administration

At UEIP:

- System was designed in 1997
- Installation occurred after a demo at the Paducah Plant



At ECP:

- Hardware design is the same as the system at UEIP
- Software was tailored for the ECP operational parameters

# A newer version of the BDMS was installed at SChE in October 2004

- SChE BDMS has more modern electronics and computers
- EM and FM have an integrated user interface
- US and Russian cooperative effort made this installation an outstanding success

# HEU Transparency Program continuously monitors all blending

- Installation was completed in October 2004
- System was calibrated in February 2005
- System collected data for all blending campaigns of 2005


# Program Accomplishments

- Established and demonstrated an effective transparency regime in the Russian Federation and the United States.
- Provided the assurance that 250 metric tons of weapons-usable HEU has been processed and blended into reactor-grade LEU for use as fuel in commercial nuclear reactors.
- Established a Transparency Monitoring Office (TMO) at UEIP. This office has been staffed almost continuously since opening in August 1996.
- Developed and installed instrumentation (BDMS) to perform continuous monitoring of HEU blending at all three Russian blending facilities.

In 2005, the 250th MT of HEU, equivalent to 10,000 nuclear devices, was blended to LEU and delivered for shipment to the United States

# HEU Transparency Program Monitoring Plans

- Continue transparency monitoring activities in Russia and the United States.
- Assure that U.S. nonproliferation objectives are met and that LEU shipments continue.
- Monitor the return of natural uranium to Russia and its ultimate disposition.
- Promote the positive results obtained by HEU Transparency Program operations to support additional initiatives for the further disposition of weapons-grade material.